ancient altar to Zeus Hypsistos, or Jupiter the Highest, and that the levelled space, with the old supporting wall, is the ancient *Pelasgicon.* This essay was answered by Professor Ross, formerly of Athens, now of Halle, in a pamphlet, published in 1853. Welcker replied by another pamphlet in 1854.

Professor Felton gave a summary of the arguments on both sides, and stated that the subject had occupied much of his attention while in Athens; — that he had come to the conclusion that the received opinion is correct; — and, in confirmation of this view, went at some length into an examination of the authorities, especially Plato, Demosthenes, Plutarch, and Proclus, citing a passage from the last-mentioned author which had never been considered before, and which was pronounced to be almost, of itself, conclusive: and quite conclusive, as the last term in a cumulative argument, the expressions being precisely applicable to the shape of the supposed Pnyx, and to no other place or structure in Athens.

Four hundred and twenty-first meeting.

December 11, 1855. — ADJOURNED QUARTERLY MEETING.

The PRESIDENT in the chair.

The following gentlemen were elected Associate Fellows; viz.: —

Rev. Moses A. Curtis of South Carolina, and Professor Charles W. Short, M. D., of Louisville, Ky., in the Section of Botany.

Drs. J. P. Kirtland, of Cleveland, Ohio, and J. C. Dalton, Jr., of New York, in the Section of Zoölogy and Physiology.

Professor Dennis H. Mahan, of West Point, in the Section of Technology and Engineering.

Hiram Powers, Thomas Crawford, William C. Bryant, and Washington Irving, in the Section of Literature and the Fine Arts.

Professor W. B. Rogers exhibited to the Academy a set of Schönbein's test-papers for ascertaining the amount of ozone

in the atmosphere, and explained their use and the great importance of the observations based upon them.

Professor Rogers also exhibited a series of diagrams explanatory of certain conditions of binocular combination not hitherto described, and intended especially to demonstrate *the form of the curve which results from the binocular union of a straight line with a circular arc, or of two equal circular arcs with one another.*

"First. Of the binocular resultant of a *straight line* and a *circular arc.*

"Assuming the optical centres of the two eyes as fixed during the act of combination, the centre of the eye directed to the circular arc may be regarded as the vertex of a cone whose surface includes all the positions of the optical axis of that eye as successively directed to the different points of the arc. This cone will of course be right or oblique, according to the direction in relation to the plane of the paper of the line joining the optical centre with the centre of the circle of which the arc is a part. The axis of the other eye, in ranging from end to end of the vertical line, vibrates in a plane which during the binocular combination intersects the conical surface in an attitude depending on the distance between the optical centres, the place of the diagrams, and the relative position of the component lines.

"The two optical axes, directed each moment to corresponding points of the vertical line and arc, meet in the conical surface, forming optically a series of resultant points which together compose the binocular resultant curve. *This curve must, therefore, be a conic section,* the nature of which will depend on the direction of the cutting plane in reference to the conical surface.

"Considering the several cases in which the arc is convex towards the right line or concave towards it, and in which the combination is effected before or behind the plane of the diagram, all the results may be thus summed up.

"(*a.*) When the arc is convex to the right line and they are united beyond the plane of the diagram, or when the arc is concave to the line and they are combined in front of it, the binocular resultant may be either an ellipse, a parabola, or an hyperbola; but in either case it will turn its convexity obliquely towards the observer.

"(*b.*) When the arc is concave to the right line and they are united

beyond the plane of the diagram, or when it is convex to the line and they are combined in front of the diagram, the binocular resultant is always an arc of an ellipse turning its convexity obliquely away from the observer.

" Second. Of the binocular resultant of *two circular arcs.*

" In this, as in the preceding combinations, the optical centres are to be regarded as immovable during the experiment. Each eye, while viewing the successive points of the arc presented to it, revolves in such manner as to carry the optical axis around in a conical surface. Thus two conical surfaces are generated, having for their respective apices the centres of the two eyes, and including all the directions which the optical axes assume in combining the successive pairs of corresponding points of the circular arcs. In general terms, therefore, *the binocular resultant in all such cases may be described as the curve line in which the surfaces of the two visual cones intersect one another.*

" It is only, however, under special conditions that the resultant thus formed is a *plane curve.* When the circular arcs presented to the two eyes are of unequal curvature, the visual cones by their intersection produce a curve which cannot be included in a plane, but lies in an inflected surface; and this accordingly is the form which the resultant takes whenever circular arcs of unlike curvature are combined either with or without a stereoscope.

" The several effects of the binocular union of circular arcs of equal length and curvature may be thus summed up.

" (*a.*) When the arcs are convex to one another, and are combined behind the plane of the components, or when they are concave to one another and combined in front of this plane, the resultant may be either an hyperbola, a parabola, or an ellipse; but in either case it will be convex towards the observer and in a vertical plane.

" (*b.*) When the arcs are concave to one another, and are combined behind the plane of the components, or when they are convex to one another and combined in front of this plane, the resultant is always an arc of an ellipse concave towards the observer and in a vertical plane.

" Whenever, in any of the combinations referred to, the resultant curve takes the position of the *sub-contrary section* of the cone, it of course becomes an *arc of a circle.*"

Professor C. C. Felton exhibited to the meeting a series of

silver coins of Athens, which he had lately received from Mr. George Finlay, of Athens, and made some remarks, of which the following is the substance.

"Mr. Finlay is the distinguished historian of the Byzantine Empire. He has resided in Athens for many years, occupied with historical studies and archæological researches. The ancient coins of Greece, and the coins of the Byzantine Empire, of which he has a large and valuable collection, have been much attended to by him, both on account of their intrinsic interest and for the illustrations they afford of numerous points in history.

"The excellence of the Athenian currency has been often the theme of eulogy. The practical sense of the Athenian people was as remarkable as their genius for literature and art. We are apt to forget, in our admiration of the Parthenon adorned by the sculptures of Pheidias, and of the tragedies of Sophocles and the orations of Demosthenes, that the same people were equally eminent in commerce, manufactures, and agriculture; that they had devised a judicious system of public revenue, and well understood the theory and practice of credit in commercial and banking operations. At an early period, the silver coinage of Athens acquired a general currency throughout the commercial world. So well did the Athenians perceive the advantage of this, that they retained, even during the periods of the highest excellence in the fine arts, much of the rudeness of the earliest mintage: so that the coins of Macedonia, and of many of the colonial states, far surpassed, in beauty of design and execution, the coins of Athens. This adherence to the archaic style was intentional; it was the result of practical wisdom, abstaining from change, in order not to affect the established credit of the ancient currency.

"The principal authorities on ancient coins are Spanheim, Eckhel, Mionnet, Boeckh, Hussey, Cardwell, and Humphrey; together with the lists of the coins in the public and private collections of Europe.

"The silver coins now exhibited are, — 1. Τετράδραχμον. 2. Δραχμή. 3. Τριόβολον. 4. Ὄβολος. 5. Τριτημόριον. 6. Ἡμιοβόλιον. 7. Τεταρτημόριον. These coins have been carefully weighed by Professor Horsford, with the following results: —

	Troy Weight.		French Grammes.
Τετράδραχμον (four drachmas),	255.99 gr.	=	16.5778
Δραχμή (drachma),	63.20		4.0929
Τριόβολον (three-obol piece, or half-drachma),	30.70		1.9883

	Troy Weight.		French Grammes.
Ὀβολος (obol, one sixth of a drachma),	10.50 gr.	=	0.6802
Τριτημόριον (three fourths of an obol),	7.27		0.4711
Ἡμιοβόλιον (half-obol),	3.47		0.2250
Τεταρτημόριον (quarter-obol),	1.50		0.0984

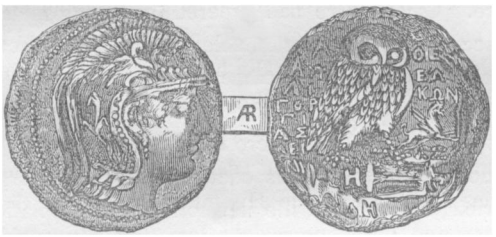
"The weight of the Attic drachma, as deduced from the relations of the Attic silver weights, and from numerous comparisons of existing specimens, has been estimated by Hussey at 66.5 grains; by Boeckh, at 67.4. If we assume 67, which is nearly the average of the two, the weight of the tetradrachmon, usually estimated at 266 gr., will be 268. The tetradrachmon now exhibited has lost, taking the larger estimate, 12.01 gr.; taking the smaller, 10.01 gr., or a little less than five per cent. The drachma has lost 3.80 gr., or about six per cent. The triobolon has lost 2.80 gr., or nearly nine per cent, and so on; the smaller the coin, the greater generally being the loss. But in all cases the loss is surprisingly small, the difference between this tetradrachmon and the standard weight being a less percentage than that between some American dollars of different dates. Cardwell states that, of twelve drachmas described in the Hunterian Catalogue, the heaviest weighs 66¼ gr., and only one weighs less than 60. Of the tetradrachma, of which the Catalogue enumerates one hundred and two, seventy range over a difference from the standard weight of not more than 10 gr., assuming the standard weight to be 266 gr., or 12, assuming it to be 268 gr. Of fourteen tetradrachma in the British Museum, the heaviest weighs 264 gr.

"The drachma now exhibited is evidently very old, — probably belonging to the sixth or the early part of the fifth century B. C. On the obverse is the head of Athena (Minerva), in the Æginetan style; on the reverse, the owl, with the olive-branch at the left and the legend A Θ on the right. The following is an exact copy.

"The figures on the smaller coins are traceable, though some of them are much worn.

"The tetradrachmon has on the obverse the head of Athena helmeted and crested. On the reverse, the owl standing upon a diota, on which is the letter H, and under it another H. The legend is

A Θ E, the first letter being on the left of the head of the owl, and the other two on the right. Below are names of three persons, probably magistrates. The first is A Π E Λ Λ I K Ω N, occupying two lines, partly on one side and partly on the other of the owl. The next, inscribed on the left of the owl, is Γ O Ρ Γ I A Σ, in three lines. And the third, which could be made out only by a careful examination, under different lights, is Δ E I N I A Σ, the first two syllables being on the left in two lines, and the third on the right of the owl. On the right of the owl, in the space between the syllables K Ω N and A Σ, there is a winged Pegasus, leaping. The three names are, then, Apellicon, Gorgias, and Deinias. The following figure represents the coin very faithfully.



"Eckhel (II. 219, 220) describes two coins of the time of Mithridates VI., the first of which has the names of *Mithridates* and *Aristion*, the second has *Aristion* and *Philon*, with three letters of a third, H Γ I; to these he subjoins a third, with the names *Apellicon*, *Gorgias*, and part of a third name, *Diosio*. Of the date of the first two there can be no doubt; whether the third is synchronous with them depends upon the identity of the Apellicon with the person bearing that name in the second. It seems highly probable that the tetradrachmon now exhibited belongs to the same period as the last of those described by Eckhel, in the passage referred to, since two of the names are the same on both.

"The winged horse is common on the coins of Mithridates, and the political connection between that monarch and the tyrant Aristion explains the introduction of the name of Aristion on a coin of the King of Pontus, and of his symbol on an Athenian coin struck by Aristion. Aristion was a Peripatetic philosopher, who, having taught in various places, was sent on a mission to Mithridates, and afterwards became tyrant of Athens. Sulla laid siege to Athens in B. C. 87. Aristion set fire to the Odeion and fled for refuge to the Acropolis; but the Acropolis having been taken, Aristion was dragged from the altar of

Athena and put to death. Apellicon was also a teacher of philosophy and a book collector, and, like some modern collectors, could not resist the temptation of stealing books, when he was unable to come honestly by them. He was obliged to flee from Athens, but returned during the tyranny of Aristion. He died just before the siege of Athens by Sulla, and his library was seized by the right of conquest (another form of stealing), and carried by the conqueror to Rome. He is noted in literary history for the possession of an autograph copy of Aristotle's works, which he procured in Asia Minor, and afterwards edited. Apellicon may be placed about 80 B. C.

" There was an Athenian Gorgias, one of the teachers of Cicero the Younger, and mentioned by him in a letter to the accomplished freedman Tiro. Cicero *père* had ordered the young man to dismiss Gorgias, on account of his questionable morals. Whether the Gorgias of the tetradrachmon is the same person, cannot be determined. He may have been of the same family, since young Cicero was in Athens about 44 B. C. He (Cicero the Younger) writes thus, after giving an account of his studious occupations: ' De Gorgia autem, quod mihi scribis, erat quidem ille in quotidiana declamatione utilis; sed omnia postposui, dummodo preceptis patris parerem. Διαῤῥήδην enim scripserat, ut eum dimitterem statim.' (Ad. Div. Lib. XVI. 21.)

" This incident shows that the name of Gorgias was not unknown at Athens, about the period to which the coin is referred. The teacher of Cicero may have been the son of the colleague of Apellicon. I find no Deinias of this period. He probably had something to do with the mint, and has left no other record of his name.

" Besides the valuable and interesting coins above described, I have, from the same accomplished scholar, a series of about eighty copper and bronze coins, embracing the common copper coins of Athens, several colonial pieces of Greek cities, with portraits of Roman emperors, seven imperial coins, with very characteristic portraits, belonging to the first three centuries; a series of coins of the Eastern Empire, commencing with Justin I. A. D. 518 – 527, and ending with Isaac II. Angelos, A. D. 1185 – 1195, the last emperor but three before the conquest of Constantinople by the Latins; and a series of six silver coins, among which are one of a Prince of Achaia, one of Manuel of Trebizond, 1238 – 1263, and a very rare silver coin of the Duke of Athens. All these are valuable in an historical point of view. During the Middle Ages, the Byzantine empire supplied the currency of Western

Europe, and her gold pieces are known in Western literature as Bezants, or Byzants. Mr. Finlay is the only writer who has set forth the financial, political, and literary history of Byzantium in its true light and its real importance.

"It is proposed here, however, to consider only the Attic copper coins, in addition to the silver pieces. They are, — 1. The Chalcus (Χαλκοῦς) and duplicate. 2. Half-Chalcus. 3. Two-Lepta piece. 4. The Lepton, the smallest product of the Attic coinage. Now, as there were seven lepta in a chalcus, and eight chalcoi in an obolos, we can conveniently construct a table of the values of the Attic currency, in our own money, by taking these and the preceding data, comparing the weight of the silver pieces with our own standard dollar, and making an allowance for the difference of alloy, which was much smaller in the ancient mint than in our own.

"Assuming the weight of the drachma, as above determined, to be 67 gr., and the per cent of alloy to be the same as in the American dollar, the drachma will be worth 16.26 cents. Adding a small per-centage for difference of alloy, and we have, almost exactly, the sixth part of a dollar, or 16.66 cents, for the value of the Attic drachma. As the drachma is the unit to which the rest of the series bear a definite proportion, we may construct the table as follows, beginning with the smallest copper coin: —

1 Lepton	=	$ 0.0004 or $\frac{4}{10}$ of a mill.
7 Lepta = 1 Chalcus	=	0.0034 or $3\frac{4}{10}$ mills.
8 Chalcoi = 1 Obolos	=	0.0277 or 2 cents $7\frac{7}{10}$ mills.
6 Oboloi = 1 Drachma	=	0.1666 or 16 cents $6\frac{6}{10}$ mills.
100 Drachmai = 1 Mna	=	16.666 or 16 dollars 16 cents $6\frac{6}{10}$ mills.
60 Mnai = 1 Talanton (Talent)	=	$ 1,000, or one thousand dollars.

"The tetradrachmon exhibited above is worth, according to the same rule of estimation, 63 cents $6\frac{1}{2}$ mills; it has therefore lost a little less than three cents. The drachma is worth 15 cents 7 mills; it has lost 1 cent $9\frac{1}{2}$ mills, — a larger rate of loss than that of the tetradrachmon, which would have been, according to this proportion, 7 cents 8 mills. But the problem of settling the comparative value of money in different ages, in reference to daily life, is another, wholly different, and much more difficult question, if indeed it can be settled at all. The comparative value of money changes with every moment of time, and every degree of latitude and longitude. If we take the price of wheat as a standard of comparison, even that is equally

fluctuating; the state of the market being affected by many influences, some permanent and regular, others casual, and all together making the price of wheat, or any other article of daily consumption, or the wages of labor, just as uncertain as the worth of money itself. This subject requires a more careful investigation than it has yet received."

Four hundred and twenty-second meeting.

January 8, 1856. — MONTHLY MEETING.

The PRESIDENT in the chair.

The Corresponding Secretary read letters from Dr. John C. Dalton, Jr., Rev. Dr. M. C. Curtis, and Dr. C. W. Short, accepting their appointment as Associate Fellows.

Dr. A. A. Gould exhibited some engraved stones found in the vicinity of Beyrout, bearing Phœnician characters, and purporting to be of great antiquity.

Professor Lovering exhibited a specimen of copal containing lizards, belonging to Captain Bertram, of Salem.

Professor W. B. Rogers, referring to the ozonometer exhibited by him at the last meeting, stated that he had recently been testing it; and had observed, during the great snow-storm of January 6th, that the quantity of ozone in the atmosphere was very great. At the time of the present meeting there was scarcely any.

Professor Rogers also gave an account of an experiment of allowing the water from a Cochituate pipe to flow with full force into a glass globe, having an outlet the axis of which was at right angles to that of the orifice by which it entered. After a short time, the water in the globe took on a rotatory motion about the axis of the outlet, and a column of air was seen to enter from the outlet in the centre of the stream of water, and extend more or less deeply into the globe in proportion to the force with which the water was allowed to enter. When the experiment was tried with a globe with two outlets, at opposite sides, the air column passed quite through it, and the water escaped as a hollow expanding cylinder at each orifice.